August 8, 2019

Via Electronic Filing

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Re: ***Unlicensed Use of the 6 GHz Band*, ET Docket No. 18-295; *Expanding Flexible Use in Mid-Band Spectrum between 3.7 and 24 GHz*, GN Docket No. 17-183**

Dear Ms. Dortch:

This letter responds to a recent filing by RigNet, Inc. and the study attached to that filing conducted by Roberson and Associates, LLC.[1] Approximately one month before RigNet submitted its most recent letter, we submitted a detailed letter highlighting several significant errors in RigNet's prior technical analyses.[2] Unfortunately, instead of correcting, or even acknowledging, the issues we raised, RigNet ignores those points entirely and repeats the same errors in its most recent analysis. Further, RigNet's recent analysis includes several new assumptions that stand out as especially inappropriate. As a result, RigNet's analyses continue to be deeply flawed and unreliable.

First, the new study mistakenly assumes an RLAN power level significantly higher than what the proposed rules would allow. Although RigNet purports to have analyzed interference from a low-power indoor device, its calculations assume a radiated RLAN power level of 1.6 W. This value was apparently derived by assuming 30 dBm conducted power and an additional 2 dB of directional gain. However, the maximum radiated power limit that we suggested, and that the FCC proposed in the NPRM for low-power indoor devices, is only 1W (30 dBm). Thus, the devices RigNet assumes in its analysis would not be permitted in the band.[3] Moreover, by assuming that this impermissibly high radiated power level is equivalent to the interfering transmit power from the perspective of a Fixed Service ("FS") receiver, RigNet apparently assumes that every RLAN device would operate with a directional antenna pointed directly at a RigNet receiver. This is almost exactly the opposite of what one observes in real RLAN deployments. As we have detailed, RLAN devices typically operate at power levels below the

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[1] *See* Letter from James Arden Barnett, Jr., Senior Vice President, RigNet Satcom, Inc., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 18-295 (filed July 11, 2019).

[2] Letter from 6 GHz RLAN Group to Marlene H. Dortch, Secretary, FCC, ET Docket No. 18-295, GN Docket No. 17-183 (filed June 19, 2019) ("First RigNet Response").

[3] These power levels would be permitted if the device were subject to Automated Frequency Coordination ('AFC") control, but RigNet appears to assume this is not the case. Of course, if these devices were subject to AFC control, the AFC would prohibit them from operating in locations where they would cause harmful interference to RigNet's or any other FS links.

regulatory limits and exhibit maximum gain in only a single direction, which is especially unlikely to be pointed out of a building window and directly at an FS receiver.[4]

RigNet compounds these mistakes with implausible assumptions about RLAN locations. FS receiver antenna beams are highly directional, are typically elevated dozens of meters off the ground, and are almost always directed away from buildings. RigNet ignores these facts. Instead, RigNet's analysis assumes, improbably, that interfering RLAN devices all operate directly in front of the FS receiver, such that the interfering RLAN signal is received with the same amount of antenna gain as the desired FS signal. In order for this to occur, a building would have to be placed directly in front of the FS receiver, completely, or almost completely, blocking the FS link. That is the only way an indoor device could operate at the precise center of an FS beam. However, because the mere presence of the building would likely be sufficient to prevent the obstructed FS link from functioning reliably, FS engineers design links to avoid this situation. Visual inspection in Google Earth confirms this common-sense conclusion as it relates to RigNet's links: there are no such buildings directly in the middle of RigNet's FS paths. Like a minority of other FS links, there may be buildings *near* or partially within the main beam of the FS receiver, but the highly directional nature of FS antennas results in a very large difference in gain at the very center of the beam (where the FS transmitter will be located) and the gain at its periphery. Finally, compounding these errors yet again, RigNet assumes that multiple RLAN devices—from 2 to 200—are all impossibly collocated at exactly the same point in space, often dozens of meters in the air.

In addition, RigNet's study assumes a number of link characteristics that are inconsistent with the registered data for RigNet's own links. For example, RigNet's analysis of its Galveston link assumes a 30 MHz FS bandwidth and operation at a modulation of 4096 QAM. However, the registration data RigNet submitted to the FCC indicates that this link has a bandwidth of 10 MHz and operates at 128 QAM.[5] Each of these factors would tend to exaggerate the risk of harmful interference compared to the ostensibly accurate registration information RigNet provided to the FCC.

Finally, RigNet's analysis includes a number of other errors that, while less striking than those described above, also contribute to RigNet's dramatic overestimation of the interference risk to its links:

1. The analysis substantially underestimates building entry loss—RigNet assumes 11 dB building entry loss. This is below the median values even for traditional, i.e., *non-thermally-efficient* buildings, as defined by the ITU, and is far below typical building entry loss for high-rise buildings.

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[4] Comments of 6 GHz RLAN Group at Appendix D, ET Docket No. 18-295, GN Docket No. 17-183 (filed Feb. 15, 2019).

[5] FCC Universal Licensing System, WPNA729 Paths Summary, https://wireless2.fcc.gov/UlsApp/UlsSearch/licensePathsSum.jsp?licKey=1038510; FCC Universal Licensing System, WPNA730 Paths Summary, https://wireless2.fcc.gov/UlsApp/UlsSearch/licensePathsSum.jsp?licKey=1038511.

2. The study overestimates the RLAN duty cycle—RigNet's assumption of a 10% duty cycle would require *every* RLAN device to stream the equivalent of several HD videos simultaneously.

3. RigNet uses an inappropriate RLAN bandwidth—the study assumes that RLAN devices will operate in 20-MHz channels even though 80-MHz and 160-MHz channels will be most common in the 6 GHz band.[6]

4. The study greatly exaggerates the probability of co-channel operation—RigNet assumes that thirty-six 20-MHz RLAN channels will be available when in fact our proposal would result in 87 such channels across the bands authorized for unlicensed use.

5. The analysis ignores other sources of attenuation—although real-world interference would be attenuated by at least 3 dB polarization mismatch loss and 2 dB of feeder loss, RigNet ignores these factors.[7]

Correcting for these errors confirms that low-power indoor devices can operate without any substantial risk of harmful interference to RigNet's or other licensees' FS links. Correcting RigNet's analysis for its Galveston link, for example, reduces the predicted noise level by more than 60 dB, to -18.89 dB I/N. Accordingly, the Commission should disregard RigNet's analyses, which continue to include numerous errors and highly unrealistic assumptions.

Respectfully submitted,

Apple Inc.
Broadcom Inc.
Cisco Systems, Inc.
Facebook, Inc.
Google LLC
Hewlett Packard Enterprise
Intel Corporation
Marvell Semiconductor, Inc.
Microsoft Corporation
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[6] *See* First RigNet Response at 2.

[7] *Id*.